# SOME RELATIONS BETWEEN THE WATER SUPPLY AND TYPHOID FEVER IN WASHINGTON, D. C.

By John Gaub

Typhoid fever, through its death rate, has proven to be the best index of the quality of the water supplied in American cities. Especially is this the case when the rate is in excess of a certain amount. Owing to the fact, however, that typhoid fever is traceable to causes other than water and that contamination of supplies is generally of progressive occurrence, this relationship as is well known to sanitarians does not readily or uniformly appear in the charts of typhoid fever rates.

To understand the conditions relative to typhoid in some communities it is essential that a discrimination be made between the normal seasonal typhoid and the abnormal prevalence due to certain conditions. This discrimination is quite essential when we recall that in many of the cities of the north the normal seasonal prevalence of typhoid is lower during the late winter and early spring than at any other season of the year; the reason for which is, that with the exception of water-borne infection the agencies of infection such as vegetables, fruits, contaminated milk, fly troubles, etc., are less active.

It is evident, however, that flood conditions which are always more intense in the early spring, constitute a serious danger to water supplies taken from surface streams and lakes. Even when a watershed is sparsely populated the washings during floods may bring down to a water intake contamination and infection from indirect sources, causing the infection, which may have been latent upon the watershed during the year, to become active.

It has been shown many times that decided decreases in the mortality from typhoid fever in cities having contaminated supplies usually followed the installation of a purification plant, and that similar decreases have followed the changes caused by a transferral from a contaminated supply to one less exposed to contamination.

In considering the typhoid death rates of Washington for some years previous to filtration and after filtration, two facts at first

present themselves, viz. (1) the rates tend to group themselves, i.e., the improvement appears to have been in periods; (2) the year after filtration does not agree with the general tendency and effect of filtration as is seen in other communities.

TABLE 1

| *Year* | *Rate per 100,000* | |
|---|---|---|
| 1898 | 64.3 | |
| 1899 | 67.2 | |
| 1900 | 74.0 | |
| 1901 | 56.3 | |
| 1902 | 74.0 | |
| 1903 | 45.0 | The periodical improvement as seen from the table and curve, up to the year 1913 is, no doubt, due to the improvement in the water supply. |
| 1904 | 44.0 | |
| 1905 | 44.0 | |
| 1906 | 45.4 | |
| 1907 | 33.1 | |
| 1908 | 35.7 | |
| 1909 | 33.7 | |
| 1910 | 23.3 | |
| 1911 | 21.1 | |
| 1912 | 22.8 | |
| 1913 | 16.2 | |

Should the year 1906 be compared with 1905 and with the results of communities having safe water supplies, it will be seen that the curve representing 1906 approaches the curve for the communities having safe water supplies, more than does 1905, especially in late winter, although the rate is somewhat high. Again, the reason for the rate for 1906 may be derived from the fact that the mains wherein the water was served during the year were not cleaned as is customary in all communities when a good water supply has been installed; on the other hand the fact that 1906 was a typhoid year should not be forgotten; and, for these reasons in the mind of the writer, the year 1906 should belong to the years previous to the installation of the filter plant. With this assumption, or fact, in mind, the work of the plant meets all generalities that have been derived from other communities when a filtration plant has been installed.

As is well known the mere absence or presence of coli in a fixed amount of water may have no significance when considered without regard to other circumstances. Most sanitarians are aware of the fact that coli are common to nearly all of the higher and lower animals. However, in reference to coli in water from human sources

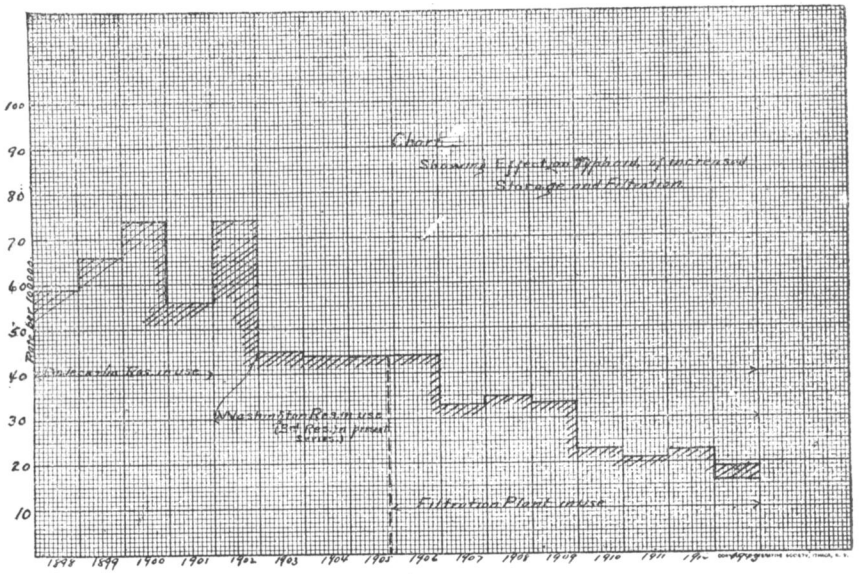


PLATE 1

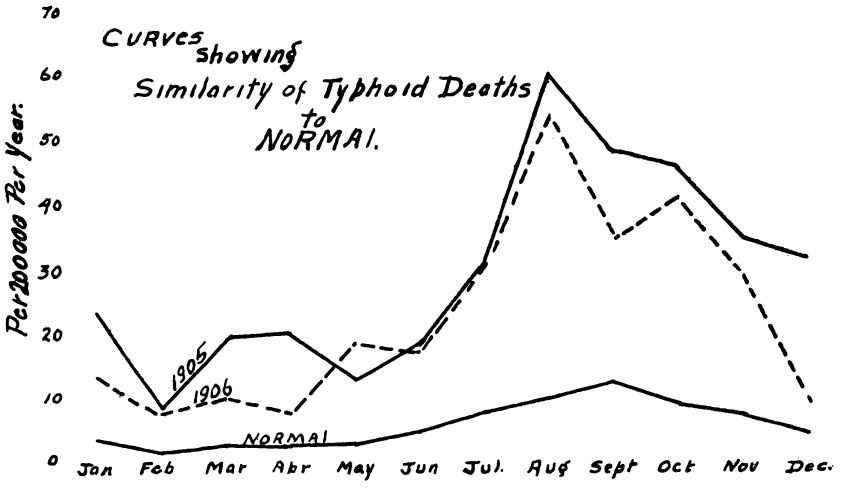


PLATE 2

it must be remembered that the population on the watershed has some influence, and for this reason, in addition to the mortality, the case incidence should have its place when comparisons are made, the effect on the ratio being due to the influence of the case incidence on the carriers. In Europe the incidence is lower and the case mortality is higher than in this country, so that the significance of coli in this country means more than in Europe. Yet it has been stated that the B. Coli content of a water does not bear a constant ratio to the typhoid rate and hence is not so important as might be expected. This statement is partly true, yet it should not be forgotten that coli do not prove the absence or presence of pathogenic organisms in a water supply, but that it is an inferential test of the danger and injury to the public health. However, when the coli content of the water per 100 cc. is averaged per month and these results compared, by means of a curve, with the averages per month of the deaths, a similarity between the two ensues for the first six months, after which the two curves depart showing that the water with its very small content of coli, if present, had no effect on the typhoid, and hence the typhoid was not wholly caused by the water supplied during that time.

Some sanitarians have, in times past, thought that the Potomac and streams south of it were different from those in the north, in that it was possible for them to cause an all-year round typhoid. This, no doubt, is contrary to the results of many investigators who have found that the death of the organisms of typhosus and coli increased with the temperature. However, to show that the typhoid of Washington does not differ from that of a northern city, the writer has plotted the typhoid rate of Toronto in comparison with that of Washington, before and after filtration, and on close examination it will be seen that the two curves are quite similar, showing that there is not much difference between the causes of typhoid in Toronto and Washington.

Again, if the rates are plotted in periods, as they appear in the table, in comparison with the normal, it will be seen that the curve for the period 1910–12 follows that for the normal quite closely. Of course the normal curve is somewhat lower than it would be were only the water supply considered, for in the cities from which it is taken there has been considerable improvement in the milk supply, fly campaigns, etc., in progress for several years, so that if a certain factor were added to the rates in these cities there would not be the difference possible as is seen from the curve.

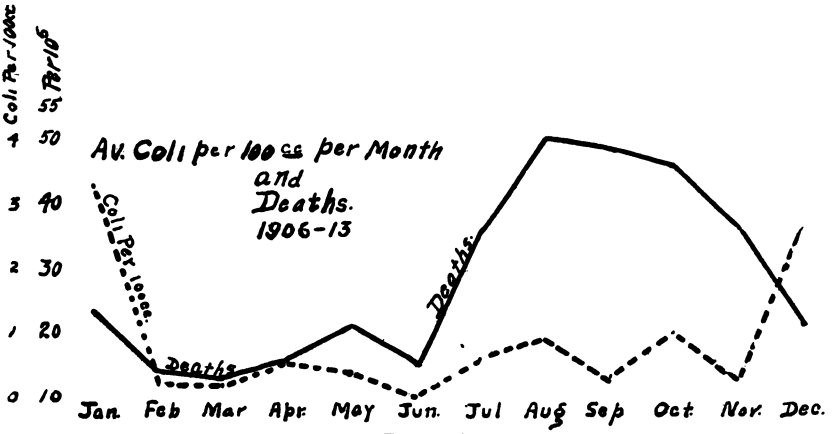


PLATE 3

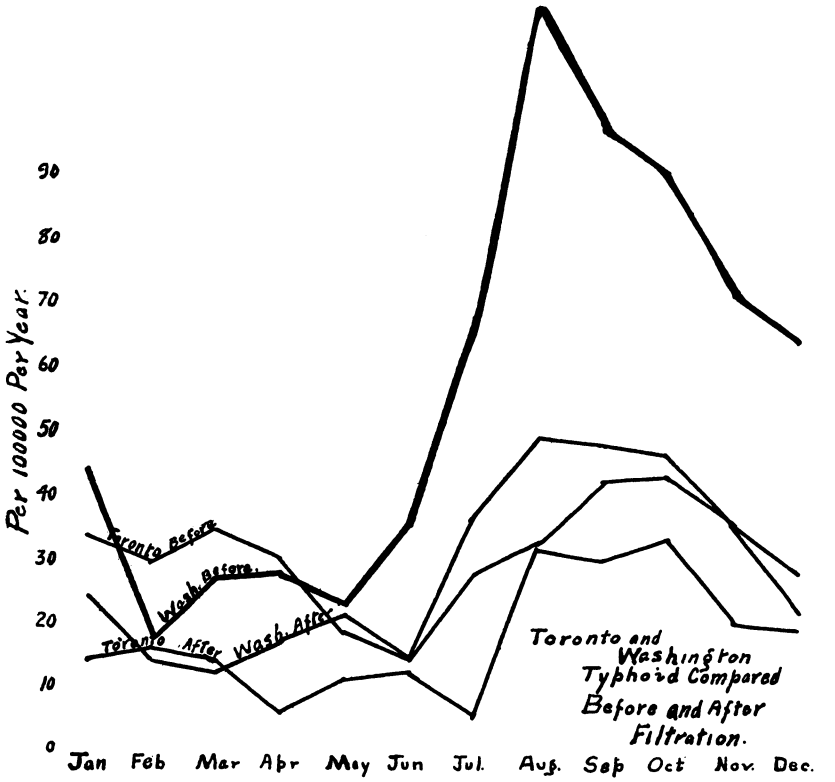


PLATE 4

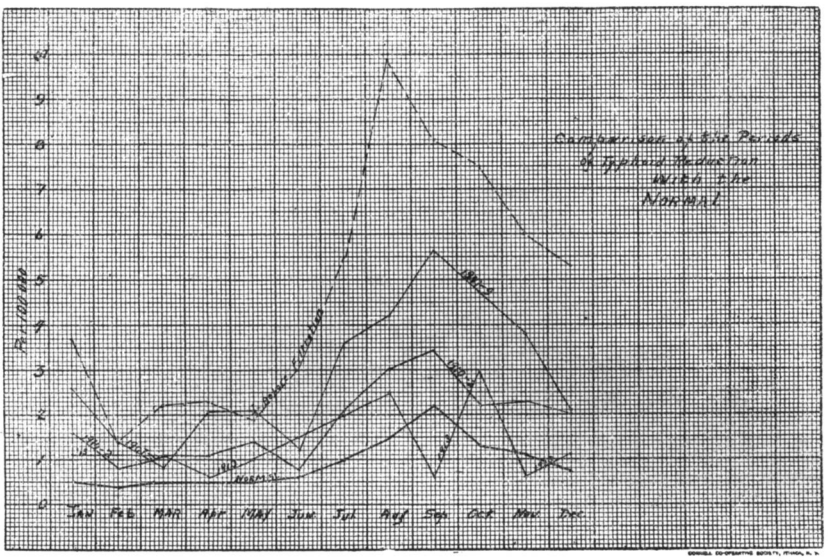

PLATE 1a

In considering the improvement in typhoid rates, several factors other than water enter; and in order to determine the results due to an improvement in the water supply it is essential that the reduction due to improvements in sanitation other than water be determined. For this determination the writer has compiled data from those cities which have no water purification.

| *City* | *Rate per 100,000* 1906–10 | *Rate per 100,000* 1911–12 |
|---|---|---|
| Buffalo | 25.2 | 18.6 |
| Detroit | 21.3 | 17.5 |
| Newark | 15.8 | 8.5 |
| Portland | 24.1 | 17.5 |
| Rochester | 15.0 | 11.5 |
| Seattle | 25.4 | 9.0 |
| St. Paul | 18.0 | 9.5 |
| Total | 144.8 | 92.1 |
| Average reduction per 100,000 | | 7.5 |

The reduction in these cities, no doubt, is due to improvements in sanitation, practised mostly in the summer months. Hence if a

similar factor is applied to the rates for 1910, 1911 and 1912 in Washington, a rate very reasonable and quite similar to that obtained in 1913 when a fly campaign was in progress is obtained; thus showing that the plant has been a factor in reducing the typhoid rate, and that other sources of the infection should be sought.

| *Year* | *Rate* | | *Rate after correction* |
|---|---|---|---|
| 1910 | 23.3 | minus 7.5 | 15.8 |
| 1911 | 21.1 | minus 7.5 | 13.6 |
| 1912 | 22.8 | minus 7.5 | 15.3 |
| 1913 | 16.2 | no correction | 16.2 |

From these figures it appears evident that the year 1912 might be taken as the dividing line for the improvement in typhoid due to filtration, while for the year 1913 the improvement is practically due to the fly campaign that was carried on successfully. However, should the correction, as above, be made, the rate in Washington would be considered good.

## CONCLUSION

1. The purification of the water supply was a big factor in reducing the typhoid rate in Washington.

2. The year 1906 should not be considered as a year in which filtered water was supplied, due to the fact that the mains were not cleaned before turning in the water.

3. The typhoid in Washington is not caused by the Potomac for twelve months in the year, as was formerly thought, and hence it does not differ from that of a northern city.

4. Considering the various factors which comprise the field of sanitation, the rate in Washington is no higher than that of any city having a good and safe water supply.